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U.S. Soil Conservation Service
Agency review of soil erosion
and sedimentation on federal
lands in Montana

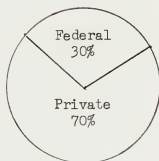
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U.S. Soil Conservation Service
Agency review of soil erosion and
sedimentation on federal lands in
Montana

STATE DOCUMENTS

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AGENCY REVIEW OF SOIL EROSION
AND SEDIMENTATION
ON
FEDERAL LANDS
IN
MONTANA



1968



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INTRODUCTION

Early in January 1968 Senator Lee Metcalf made a formal request to Don A. Williams, Administrator of the Soil Conservation Service, United States Department of Agriculture, to assemble a report on the current status of soil erosion and sediment damage that occurs on or may come from Federally managed lands in Montana. Senator Metcalf expressed concern that lands administered by the Federal agencies may be contributing to both water and air pollution. (An accelerated action may be required to minimize the problem.) Mr. A. B. Linford, State Conservationist of the Soil Conservation Service in Montana, was asked to make an agency-by-agency survey of the soil erosion problem and to review the conservation practices and standards being used by these agencies for their adequacy in protecting the soil and water resources of Montana.

Upon receiving this request, a review was made with representatives of principal land managing agencies to determine what data was available and how it might be assembled. A table of land use and treatment needs was developed to gather and analyze this information by Federal agencies.

Each agency was asked to review land use data it may have developed for River Basin Studies when submitting the information called for in the table. In support of this data each agency provided a short narrative statement relating to critical conditions which contribute most to stream pollution through sediment damage from Federal lands. These four conditions are:

1. Describe the "frail lands" that are highly susceptible to erosion damage and the kinds of geologic formation with which they are associated.

- a. What are the soil characteristics with regard to depth, texture, drainage, etc.?
- b. What are major landscape features such as length and steepness of slope?
- c. What are the major kinds and amounts of plant cover present?
2. Describe and locate the major areas where soil erosion is contributing to stream sediment pollution.
 - a. What are the soil characteristics most common to these areas?
 - b. What are the landscape features associated with these areas?
 - c. What are the kinds and amounts of plant cover present?
3. Estimate the miles of permanent streams and shorelines where stream-bank erosion is contributing to stream pollution or sediment damage.
 - a. What percent can be controlled by management type practices?
 - b. What percent needs structural measures along with management for adequate control?
 - c. What percent is not feasible to control?
4. Estimate the miles of roads and adjacent disturbed areas where soil erosion is contributing to stream pollution.
 - a. Estimate the percent that is feasible to treat by vegetation and management.
 - b. Estimate the percent needing structural measures in addition to vegetation control.
 - c. Estimate the percent not feasible to treat.

Each agency was asked to provide a list of conservation practices and standards being used to control soil erosion and sediment damage. In reviewing the standards and specifications for the prevention of soil

erosion and sediment damage, it appears each of the Federal agencies has adequate standards to meet the conservation needs and to protect the soil and water resources. The problem lies in getting the financial assistance needed to carry out the practices that will correct or alleviate the soil erosion and sediment problems.

The percentage of Federally owned land needing treatment and feasible to treat closely parallels the needs on private land. The application of conservation treatment practices on both private and Federal lands should be brought into balance simultaneously in order to adequately meet the problem. Our soil and water resources are much too valuable to permit further abuse and deterioration on either private or Federally managed lands for the protection of the other.

Approximately 70 percent of the land in Montana is in private ownership. Of the privately owned lands, 66 percent is in range or pasture, 22 percent is being cropped, 10 percent is in forest, and only 2 percent is in other uses, which includes farmsteads and urban and built-up areas. Technical assistance in meeting the soil and water conservation needs of these private lands is provided by the Soil Conservation Service through well organized and active soil and water conservation districts.

FEDERAL ASSISTANCE IN THE WAY OF FINANCIAL SUPPORT IS NEEDED IN ALL PHASES OF LAND USE PLANNING FOR THE SOCIAL AND ECONOMIC NEEDS OF OUR PEOPLE.

Interagency Agreements and Memorandums of Understanding

In Montana, the Soil Conservation Service of the Department of Agriculture has entered into several agreements with other Federal agencies as well as State agencies to provide technical assistance and

guidance in the development of soil and water conservation programs that will benefit more people with less duplication of effort between agencies. The Soil Conservation Service has memorandums of agreement with the following agencies.

1. U. S. Forest Service in Region 1, for the purpose of cooperating to obtain snow survey and soil moisture measurements which serve as basic data for making water supply forecasts for many purposes, including municipal water supply and reservoir management for irrigation and flood control.
2. The Bureau of Land Management, U. S. Department of Interior, for a coordinated effort in land use planning. The two agencies are to cooperate fully and freely in the exchange of ideas and information relative to all resource conservation development and management programs under their jurisdiction.
3. The Bureau of Land Management, Montana Fish and Game Department, and Soil Conservation Service have completed an agreement to conduct a medium intensity soil survey on five tracts of land totaling 9,800 acres in Petroleum County for the purpose of evaluating vegetative cover under different systems of livestock and game management.
4. The Bureau of Sports Fisheries and Wildlife, U. S. Department of Interior, and the Soil Conservation Service have developed agreements for conducting the following kinds of surveys within the Bureau of Sports Fisheries and Wildlife refuges.
 - a. Soil survey and range site and condition surveys on approximately 30,000 acres of the Medicine Lake Wildlife Refuge in Sheridan County, Montana.

- b. Range site and condition survey on approximately 20,000 acres of Moiese Bison Range located in Lake and Sanders Counties, Montana.
 - c. Soil survey and range site and condition surveys on 15,500 acres of the Bowdoin National Wildlife Refuge in Phillips County, Montana.
 - d. Soil survey of medium and high intensity on 52,200 acres in the Nichols' Coulee area within the Charles M. Russell National Wildlife Range in Montana and range site and condition surveys on 137,000 acres.
 - e. Soil survey and range site and condition survey on 30,000 acres of the Red Rock Lakes National Wildlife Refuge in Beaverhead County, Montana.
 - f. Engineering surveys on approximately 265 acres for irrigation systems and land leveling in the Fort Peck and Nichols' Coulee areas in Montana.
- 5. The Corps of Engineers, Northern Pacific Division, and the Soil Conservation Service in the Columbia-North Pacific have an agreement to furnish the Corps with snow measurement data as it becomes available.
 - 6. The Department of the Air Force and the Soil Conservation Service have a working agreement for conducting field investigations, engineering analyses, and where necessary, prepare plans and specifications for correction of potential drainage problems on Malmstrom ICM sites numbered R-21 and S-40.
 - 7. The Yellowstone National Park Service and the Soil Conservation Service have an agreement that SCS furnish up to three employees to assist with determination of the site and condition survey of the Northern Yellowstone Park winter elk range.

8. The Montana Highway Department and the Soil Conservation Service have a cooperative agreement for testing and evaluating the engineering properties of soils.
9. The State Water Conservation Board of Montana and the Soil Conservation Service have a working agreement that the Service will furnish the Board snow survey data in the Ruby, Musselshell and Smith River drainage.
10. The Department of Civil Engineering and Engineering Mechanics at Montana State University and the Soil Conservation Service have several agreements relative to making soil surveys and collecting snow survey data:
 - a. Soil survey information for four watersheds in Montana where hydrologics research is being done. These include:
 - (1) Bacon Creek, near Harlowton, 21 square miles
 - (2) Hump Creek, near Reedpoint, 7 square miles
 - (3) Duck Creek, near Brockway, 54 square miles
 - (4) Loneman Coulee, near Valier, 14 square miles
 - b. Gathering additional snow survey data during the regular snow survey season on the above four watersheds.
 - c. Renewal of cooperative agreements between Montana State University and the Soil Conservation Service on water supply forecasting in the State of Montana.
11. The Bureau of Reclamation, Soil Conservation Service, and the Montana State University have a working agreement to study the reclamation of saline-alkali soils in connection with the Bureau's irrigation development in Helena Valley, Montana.

There are a number of memorandums of understanding between the Soil Conservation Service of the Department of Agriculture and the Bureau of Reclamation and the Bureau of Indian Affairs of the Department of Interior dealing with the programs of soil and water. There are three memorandums of understanding with the Bureau of Reclamation. Two of these deal with snow survey data and related hydrologic studies and investigations for better control of the water resources within the jurisdiction of Bureau projects. The third memorandum deals with soil and water technical advice and assistance needed by water users and land owners of the East Bench unit of the Missouri River Basin Project in Beaverhead and Madison Counties.

The Soil Conservation Service has a memorandum of understanding with the Bureau of Indian Affairs for conducting a standard soil survey of the Big Horn Area. This is a joint effort by both agencies to complete a soil survey, with the Soil Conservation Service having the party leadership.

A memorandum of understanding exists between the following agencies:

Northeast Montana Soil and Water Research Committee
and
Roosevelt County Soil Conservation District
and
Montana Agricultural Experiment Station
and
Montana Cooperative Extension Service
and
Soil Conservation Service, USDA
and
Soil and Water Conservation Research Division of Agricultural
Research Service, USDA

This memorandum is relative to the cooperative investigations in and demonstrations of efficient soil and water management in northeast Montana and its application to nonirrigated agricultural lands with similar soils and climate.

Montana Land and Water

Land and water area in Montana comprises 147,138 square miles or 94,168,320 acres.^{1/} The inland water acreage is 982,400 acres and includes bodies of water more than 40 acres in size and streams more than one-eighth of a mile wide. These water areas are represented as part of other land in both private and Federal ownership, as shown in the pie-shaped charts in Figure 1.

For land use comparison, circular diagrams in Figure 1 show the percentage of major kinds of land use under the administration of both private and Federal ownership. The amount of cropland in Federal ownership was too small to show in the diagram and was included with other land.

Other land in both private and Federal ownership includes all water areas more than 2 acres in size; urban and built-up areas, which include cities, towns, roads, railroads, and industrial developments; farmsteads and investment tracts; and primitive wilderness areas.

^{1/} Data from U. S. Department of Commerce, Areas of Montana, 1960, CE-20, No. 28

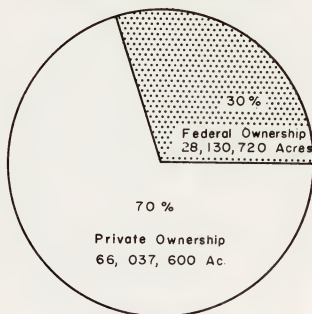
FIGURE 1

LAND AND WATER AREA IN MONTANA = 94,168,320 ACRES

LAND AREA = 93,185,920 Ac

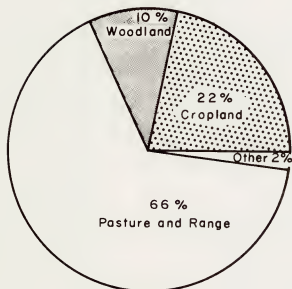
INLAND WATER AREA = 982,400 Ac

LAND OWNERSHIP



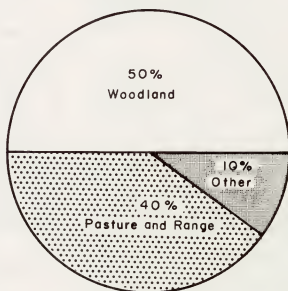
LAND USE

PRIVATE LAND



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FEDERAL LAND



1968-REVIEW



Introduction to Land Use and Treatment Needs

A series of five tables was developed to show the relationship of land use acreage and treatment needs by kinds of use on Federally managed lands in Montana. It is interesting to note the comparative needs on Federal and private lands in regard to the kinds of practices for a particular use. Range and pasture land use is a good example for comparative treatment needs on private and Federally owned lands. Sixty-six percent of the privately owned lands and forty percent of the Federally owned lands are in this kind of use. On private lands there are 43,142,283 acres of range, of which about 30,000,000 acres or seventy percent needs treatment and is feasible to treat. On Federally owned lands there are 11,101,746 acres of range, of which about 7,000,000 acres or sixty-two percent needs treatment and is feasible to treat. The need for application of conservation practices to adequately treat these lands is equally important under private or Federal management. For example, reducing the number of domestic livestock permitted to graze public lands as a management technique would increase the grazing pressure on private range. There needs to be careful development of long range plans to meet the multiple use concept on Federally managed lands. Table 1 provides a summary of the land use acreage administered by each Federal agency for woodland, range and pasture, cropland, primitive or wilderness areas, and other lands which include water areas larger than 40 acres in size.

Table 1A shows the treatment needs for woodland use and the acreage administered by each Federal agency. The acreages of highly erosive lands and recent burns under woodland use are given in this table.

Table 1B shows the treatment needs for range and pasture use and the acreage administered by each Federal agency. The acreages of critical areas, erosive lands and recent burns under range use are given in this table.

Table 1C shows the treatment needs for cropland use and the acreage administered by each Federal agency. The acreage of erosive land under cropland use is given in this table.

Table 1D provides a summary of treatment needs by land use and the acreage administered by each agency. The acreage and percent of land adequately treated, not feasible to treat, needing management only, and needing structures and management are shown in this table for woodland, range and pasture, and cropland.

TABLE 1. SUMMARY OF LAND USE ACREAGE IN MONTANA BY FEDERAL AGENCIES

Federal Agency	Total Acres	Woodland	Range and Pasture	Cropland	Primitive Wilderness	Other
U. S. Forest Service	16,670,385	11,924,791	2,724,900	0	1,892,600	128,094
Bureau of Land Management	8,226,327	1,089,000	7,137,300	0	0	0
Bureau of Indian Affairs	125,105	405	98,360	24,038	0	2,302
Bureau of Sports Fisheries and Wildlife	1,124,889	255,000	650,000	7,000	100	213,739 ^{1/}
Bureau of Reclamation	162,000	7,000	129,000	0	0	26,000
Glacier National Park Service	1,013,129	768,998	59,040	0	0	185,091
Yellowstone National Park Service	143,000	128,500 ^{2/}	14,300 ^{2/}	0	0	200 ^{2/}
Agricultural Research Service	55,800	0	54,950	400	0	450
Corps of Engineers	610,085	0	233,896	0	0	376,189 ^{1/}
TOTAL	28,130,720	14,173,694	11,101,746	31,438	1,892,700	932,065
Percent by use	.	50.0%	39.6%	0.2%	6.8%	3.4%

^{1/} Fort Peck Reservoir and other bodies of water more than 40 acres in size.

^{2/} These are estimates by SCS since the Yellowstone Park Service did not give a breakdown by land use.



TABLE 1A. LAND USE AND TREATMENT NEEDS FOR WOODLAND BY FEDERAL AGENCIES IN MONTANA

Federal Agency	Total Acres	<u>Critical Areas</u>		Percent Adequately Treated	Percent not Feasible To Treat	<u>Percent Needing Treatment</u>	
		<u>Erosive Lands</u>	<u>Recent Burns</u>			<u>Management only</u>	<u>Structures and Mgt.</u>
U. S. Forest Service	11,924,791	110,000	14,751	96.5	0	0.2	3.3
Bureau of Land Management	1,089,000	280,000	10,000	25.0	47.0	28.0	0
Bureau of Indian Affairs	405	0	0	97.0	3.0	0	0
Bureau of Sports Fisheries & Wildlife	255,000	245,000	8,000	50.0	5.0	45.0	0
Bureau of Reclamation	7,000	0	0	35.0	0	40.0	25.0
Glacier National Park Service	768,998	0	12,381	97.0	1.0	2.0	0
Yellowstone National Park Service	128,500	10,000	0	99.0	1.0	0	0
Agricultural Research Service	0	0	0	0	0	0	0
Corps of Engineers	0	0	0	0	0	0	0
TOTAL	14,173,694	645,000	45,132	90.0	3.8	3.4	2.8



TABLE 1B. LAND USE AND TREATMENT NEEDS FOR RANGE AND PASTURE BY FEDERAL AGENCIES IN MONTANA

Federal Agency	Total Acres	<u>Critical Areas</u>		Percent Adequately Treated	Percent not Feasible To Treat	<u>Percent Needing Treatment</u>	
		<u>Erosive Lands</u>	<u>Recent Burns</u>			<u>Management only</u>	<u>Structures and Mgt.</u>
U. S. Forest Service	2,724,900	550,000	22,100	43.8	0	50.9	5.3
Bureau of Land Management	7,137,300	2,377,000	9,000	25.0	7.7	53.7	13.6
Bureau of Indian Affairs	98,360	5,586	1,000	65.0	3.0	15.0	17.0
Bureau of Sports Fisheries & Wildlife	650,000	100,000	0	50.0	0	50.0	0
Bureau of Reclamation	129,000	0	0	32.0	1.0	26.0	41.0
Glacier National Park Service	59,040	0	24	100.0	0	0	0
Yellowstone National Park Service	14,300	5,000	0	30.0	1.0	65.0	4.0
Agricultural Research Service	54,950	54,000	0	37.0	1.0	45.0	17.0
Corps of Engineers	233,896	Unknown	120	100.0	0	0	0
TOTAL	11,101,746	3,091,586	32,244	33.5	5.0	50.8	10.7



TABLE 1C. LAND USE AND TREATMENT NEEDS FOR CROPLAND BY FEDERAL AGENCIES IN MONTANA

Federal Agency	Total Acres	<u>Critical Areas</u>		Percent Adequately Treated	Percent not Feasible To Treat	<u>Percent Needing Treatment</u>	
		<u>Erosive Lands</u>	<u>Recent Burns</u>			<u>Management only</u>	<u>Structures and Mgt.</u>
U. S. Forest Service	0						
Bureau of Land Management	0						
Bureau of Indian Affairs	24,038	2,850	0	74.0	0	11.0	15.0
Bureau of Sports Fisheries & Wildlife	7,000	0	0	100.0	0	0	0
Bureau of Reclamation	0	0	0				
Glacier National Park Service	0						
Yellowstone National Park Service	0						
Agricultural Research Service	400	0	0	100.0	0		
Corps of Engineers	0						
TOTAL	31,438	2,850	0	80.0	0	8.4	11.6

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TABLE 1D. SUMMARY OF TREATMENT NEEDS BY LAND USE AND FEDERAL AGENCIES IN MONTANA

Federal Agency	Acres	Percent Adequately Treated	Acres Adequately Treated	Percent Not Feasible To Treat	Acres Not Feasible To Treat	Percent Needing Mgt. Only	Acres Needing Mgt. Only	Percent Needing Structures and Mgt.	Acres Needing Structures and Mgt.
WOODLAND									
U. S. Forest Service	11,924,791	96.5	11,507,423	0	0	0.2	23,849	3.3	393,518
Bureau of Land Management	1,089,000	25.0	272,250	47.0	511,830	28.0	304,920	0	0
Bureau of Indian Affairs	405	97.0	393	3.0	12	0	0	0	0
Bureau of Sports Fisheries & Wildlife	255,000	50.0	127,500	5.0	12,750	45.0	114,750	0	0
Bureau of Reclamation	7,000	35.0	2,450	0	0	40.0	2,800	25.0	1,750
Glacier National Park Service	768,998	97.0	745,928	1.0	7,790	2.0	15,380	0	0
Yellowstone National Park Service	128,500	99.0	127,215	1.0	1,285	0	0	0	0
Agriculture Research Service	0	0	0	0	0	0	0	0	0
Corps of Engineers	0	0	0	0	0	0	0	0	0
TOTAL	14,173,694	90.0	12,783,159	3.8	533,667	3.4	461,699	2.8	395,268
RANGE & PASTURE									
U. S. Forest Service	2,724,900	43.8	1,193,506	0	0	50.9	1,386,974	5.3	144,420
Bureau of Land Management	7,137,300	25.0	1,784,325	7.7	549,572	53.7	3,832,730	13.6	970,673
Bureau of Indian Affairs	98,360	65.0	63,924	3.0	2,951	15.0	14,754	17.0	16,721
Bureau of Sports Fisheries & Wildlife	650,000	50.0	325,000	0	0	50.0	325,000	0	0
Bureau of Reclamation	129,000	32.0	41,280	1.0	1,290	26.0	33,540	41.0	52,890
Glacier National Park Service	59,040	100.0	59,040	0	0	0	0	0	0
Yellowstone National Park Service	14,300	30.0	4,290	1.0	143	65.0	9,295	4.0	572
Agriculture Research Service	54,950	37.0	20,331	1.0	550	45.0	24,728	17.0	9,341
Corps of Engineers	233,896	100.0	233,896	0	0	0	0	0	0
TOTAL	11,101,746	33.5	3,725,592	5.0	554,503	50.8	5,627,021	10.0	1,194,617
CROPLAND									
U. S. Forest Service	0								
Bureau of Land Management	0								
Bureau of Indian Affairs	24,038	74.0	17,788	0	0	11.0	2,644	15.0	3,606
Bureau of Sports Fisheries & Wildlife	7,000	100.0	7,000	0	0	0	0	0	0
Bureau of Reclamation	0								
Glacier National Park Service	0								
Yellowstone National Park Service	0								
Agriculture Research Service	400	100.0	400	0	0	0	0	0	0
Corp of Engineers	0								
TOTAL	31,438	80.0	25,188	0	0	8.4	2,644	11.6	3,606



Forest Service Report

The Forest Service in the United States Department of Agriculture administers 16,670,385 acres of Federally owned lands in Montana. There are 11,924,791 acres in woodland use, of which 96.5 percent is adequately treated. Only 0.2 percent needs management practices and only 3.3 percent needs structural measures and management practices. There are 2,724,900 acres of rangeland, of which 43.8 percent is adequately treated, 50.9 percent needs management practices, and only 5.3 percent needs structures and mechanical measures in addition to management practices for adequate protection. There are 1,892,600 acres in primitive or wilderness areas, of which 95 percent is adequately treated and 5 percent is not feasible to treat. Other land comprises 128,094 acres, which include water areas, roads, trails, etc. within the National Forest.

The critical areas include erosive lands and recent burns where the vegetation has been destroyed by fire within the past five years. There are 110,000 acres of sparsely vegetated woodland on highly erosive lands and 14,751 acres of woodland that has burned recently. There are 550,000 acres of rangeland on highly erosive soil that, if not protected from over use, will experience accelerated erosion. There have been 22,100 acres of rangeland vegetation damaged or destroyed by fire within the past five years. The primitive or wilderness areas have 100,000 acres of erosive lands which are not necessarily eroding but occur primarily in the alpine or subalpine areas where vegetation is sparse due to adverse climate and shallow rocky soils. In these areas the natural geologic processes of erosion are taking place and the accelerated weathering of the parent rock is of limited duration. Fire has destroyed the vegetation on 1,650 acres during the past five years.

The lands within the National Forests considered to be most susceptible to erosion damage are: (a) the sparsely vegetated areas of the alpine and subalpine zones, (b) excessively steep slopes where the soils are shallow and underlain by easily weatherable rock such as soft shale and sandstone or granite rocks that are easily fractured by the weathering process, and (c) combinations of soil and geologic factors that produce massive land movements (sluffs or slips) under certain soil-moisture conditions. Although these areas may be small, locally they can contribute large quantities of sediment (silt and clay) during the spring runoff and during high intensity summer showers. Taylor's Fork, a tributary of the West Gallatin River, and the West Fork of the Madison River are examples of streams producing periodic sediment pollution from Federally owned lands.

Within the National Forest of Montana it is estimated there are 538 miles of streambank and lakeshore needing protection and stabilization to reduce sediment pollution. These estimates are based on the miles of stream needing structural measures to protect their banks from further soil loss. Control is feasible on 75 percent of these miles if funds were available.

It is estimated there are 1,513 miles of abandoned roads and trails in the National Forest of Montana that need some treatment (vegetative or structural) to prevent soil loss and further deterioration. It is estimated that only 10 percent is feasible to treat by vegetation and 90 percent will need some structural measures with vegetative control. These needs are reflected in the acres needing treatment and feasible to treat within each major land use category.

Bureau of Land Management Report

The Bureau of Land Management in the United States Department of Interior administers 8,226,327 acres of Federally owned lands in Montana. This acreage excludes the Charles M. Russell Wildlife Range and the Big Horn Canyon NRA which are administered by other agencies. There are 7,137,300 acres of range and pasture land, of which only 25 percent is adequately treated, 53.7 percent needs improved management practices, 13.6 percent needs structures and mechanical measures in addition to improved management practices, and 7.7 percent is not feasible to treat. The latter includes the badlands of shale and rock outcrop and isolated inaccessible areas with which they are associated. There are 1,089,000 acres of woodland, most of which is grazed and only 15 percent adequately treated, 47 percent is not feasible to treat and 28 percent needs management practices only.

The critical areas represent the acreage of "frail lands" and recent burns where there is insufficient plant cover to protect the soil from the erosive forces of nature. There are actually many acres of "frail land," which, if the vegetation were reduced further through improper use, would become more severely eroded. There are 2,377,000 acres of "frail lands" in range and pasture which have insufficient plant cover to protect the soil. These lands are highly susceptible to erosion. The soils are characterized by a thin unstable topsoil, or, in some instances, no topsoil at all. Subsoils are usually clays, fine silts, or sands, depending on the source of parent material with which they are associated. These soils vary greatly in depth and texture but are underlain by soft sedimentary beds of shale and sandstone.

There are approximately 547,600 acres or 8 percent of the rangeland not feasible to treat. These are principally the barren badlands having more than 60 percent exposed shale or sandstone which erode under normal geologic conditions. There are 280,000 acres of sparsely vegetated woodland in the frail land areas. Soil characteristics are much the same as for rangeland and maximum treatments are needed to protect the soil resource and reduce erosion. Within the past five years, fire has destroyed the vegetation on 10,000 acres of woodland and 9,000 acres of range. Major areas where soil erosion is contributing to stream pollution are:

A. Malta District

1. Willow Creek drainage in Valley County. Soils are generally heavy clays. Slopes vary from flat to moderately steep. Average plant cover is about 15 percent.
2. Larb Creek drainage in Valley County. Soils are a mixture of clay shales and gravels. Slopes vary from extremely steep to nearly level. Average plant cover is about 20 percent.
3. South Bearpaw Area in Blaine County. This area includes the Cow Creek, Birch Creek, and Bullwhacker drainages. Relief is highly broken as a result of geologic erosion. Stream gradients are about one percent for the main drainages. Outside drainages have gradients up to 30 percent. Soils are generally unconsolidated shales. Plant cover varies from zero percent to 25 percent.

B. Miles City District

1. Cedar Creek drainage in Dawson County. The area consists of thin, poorly developed soils and badlands of raw shale. Topography is rough to steeply rolling, dissected by numerous stream channels.

Plant cover varies considerably from a sparse cover of native grasses to trees and shrubs in some stream bottoms. Ground cover probably averages less than 20 percent.

2. Powder River drainage in Powder River County. Badlands and breaks area adjacent to the river characterized by little soil development because of geologic erosion. The area is rough with slopes often exceeding 60 percent. Vegetation is frequently sparse to nonexistent.
3. Little Missouri River drainage in Carter County. Soils are derived from Pierre Shale, the Niobarra Formation, and other clay shale parent materials. They lack B horizons and have only a thin A horizon if any at all. Topography is gently to steeply rolling. Vegetation varies from sparse native grasses to annual weeds to salt sage.

C. Billings District

1. Tributary drainages to the Clark Fork in Carbon County. Included here are the Cottonwood, Silvertip, Hollenback and Red Springs drainages. These are areas typical of the Big Horn Basin. They are generally clay soils with little vegetation except for salt sage. Soils are poorly developed.
2. Gyp Creek in Carbon County. This is an area derived from limestone parent material. Soils vary from sandy to clay in the lower portions. Vegetation is extremely sparse.

D. Dillon District

The public land areas in Beaverhead and Madison Counties are highly variable. Erosion normally occurs during rapid snowmelt in the

spring, and is generally a result from lack of vegetation management or from past mining activity which may have left spoil piles or barren slopes.

E. Lewistown District

The major drainages with soil losses include Crooked Creek, Blood Creek, Armells Creek, Woodhawk Creek and Two Calf Creek. The watershed to these drainages are in Petroleum or Fergus Counties. They all terminate in the Missouri or Musselshell Rivers and pass through the rough breaks of some badlands. Soils are primarily shallow. Clay texture is derived from shale parent material. Exposed shale outcrop is frequent on the steeper slopes. Topography varies from gently rolling to extremely steep. Plant cover is only moderate on the open range lands (25 to 50 percent ground cover). Some of the rough breaks have sparse timbered cover.

There are at least 62 miles of permanent streams where streambank erosion is contributing to pollution or sediment damage. (Most of the streams having high sediment concentration are classed as ephemeral.)

It is estimated:

1. 40 percent can be controlled by management,
2. 5 percent needs structural measures for control,
3. 55 percent is not feasible to control.

There are many areas in Type IV land pattern that are considered feasible to treat. In this land ownership pattern, public lands are highly scattered and intermingled with private land. The Bureau of Land Management probably will not be requesting funds for these lands because of higher priority needs. Also, many of the streams have a high percentage

of adjacent private lands and more suitable sites for structural control measures exist on these private lands.

There are 499 miles of roads and adjacent disturbed areas that are contributing to stream sediment pollution, not including many miles of unimproved jeep trails. It is estimated the total number of miles does not exceed 2000.

1. 11 percent is feasible to treat by vegetation.
2. 33 percent needs structural control
3. 56 percent is not feasible to treat.

Considered as structural control would be installation of culverts and water bars as well as possible measures to lessen the slope.

Within the percent considered not feasible to treat are sites where the cuts or fills are too steep to reseed or where natural vegetation is gradually reestablishing or where major reconstruction of the road will be necessary to stop sediment production.

Bureau of Indian Affairs Report

The Bureau of Indian Affairs in the United States Department of Interior administers 125,105 acres of Federally owned lands in Montana. Tribal and individually owned lands within the Reservation boundaries are not included. The Reservation agencies administering these Federal lands are as follows (the report includes the consolidation of all agencies):

1. Blackfeet Agency 11,223 acres
2. Crow Agency 1,100 acres
3. Flathead Agency 1,739 acres
4. Fort Belknap Agency 25,535 acres
5. Fort Peck Agency 85,508 acres

The Northern Cheyenne Agency has less than one acre so it is not included.

There are 98,360 acres of range and pasture, of which 65 percent is adequately treated and 15 percent needs improved management practices only. There is 17 percent that needs some structural type practices along with improved management, and 3 percent is not feasible to treat. There are 5,586 acres of range on critical lands which are highly erosive. Most of these lands have thinly developed shallow soils that are underlain by soft beds of shale or sandstone. Shale and rock outcrop are common in these areas. Locally, coarse textured sandy soils present both a wind and water erosion problem. Some soils derived from shale are clay texture and have high salt concentration. These critical areas support only a sparse inferior type of vegetation which, if not adequately protected, will deteriorate rapidly and increase the erosion on these lands. Once the vegetation is destroyed, it is very difficult to reestablish an adequate cover on these lands.

There are 24,038 acres of cropland, of which 969 acres are irrigated. There is 74 percent of the cropland adequately treated and 26 percent needs treatment. Of that needing treatment, 11 percent needs improved management practices only, and 15 percent needs some structural measures with improved management practices. There are 2,850 acres of cropland in critical areas that are highly erosive when not properly managed. These are mostly sandy lands that usually are intermingled with better soil areas. They need intensive treatment for adequate protection.

The woodland portion comprises only 405 acres, of which 97 percent is adequately treated and 3 percent is not feasible to treat. The woodland areas which are not feasible to treat consist of sparse scatterings of inferior trees in the rough breaks of the drainage.

There are 2,302 acres of other lands, which consist of water, roads, and trails within the jurisdiction of the agencies. Of these lands, 87 percent is adequately treated and 13 percent needs treatment.

Improperly managed farm lands are contributing most to silt pollution and sedimentation of the streams. Crop residue, proper and timely tillage, grassed waterways, and revised irrigation and drainage systems are needed in some areas for adequate protection. The deep alluvial soils along small tributaries have an extremely high erosion potential. Normally these drainages have small streamflow but when subjected to heavy runoff from snowmelt or prolonged heavy rains, they carry large volumes of water loaded with silt and deeply incise the landscape. The rapid runoff from the shale and sandstone areas intensify the problem.

The Government owned lands that are interspersed with tribal and private lands within the Reservation have several major streams adjoining

or passing through their boundary. These include the Missouri, Yellowstone, Big Horn, Muddy Creek, Flathead, Milk, Poplar, Cut Bank, Little Big Horn, Wolf Creek, and many small streams. Portions of all these streams have streambank erosion problems. There are about 10 miles of Federally owned lands within the Reservation that have streambank erosion problems. Good watershed management practices to control runoff would meet the needs for 15 percent of the area, and 5 percent would need structural measures for adequate protection. It is estimated that 80 percent of the 10 miles of stream would not be feasible to treat.

There are 15 miles of roads and adjacent disturbed areas needing treatment. As much as 98 percent of the erosion could be controlled with vegetative plantings and only 2 percent require structural measures. (Most lands within Reservations are trust lands operated and managed as private lands.)

Bureau of Sports Fisheries and Wildlife Report

The Bureau of Sports Fisheries and Wildlife in the United States Department of Interior administers 1,124,889 acres of land and water in Montana, most of which is in Federal ownership. This acreage includes some private land leased to the Bureau, which is under its administration, as well as some Federal lands which are cooperatively administered.

There are 650,000 acres of rangeland, of which about 50 percent is adequately treated and 50 percent needs management treatment only. Nearly 100,000 acres of the range are on critical lands which are highly erosive. Most of the critical areas are along the Missouri River breaks portion of the Charles M. Russell range. The geologic materials consist mostly of soft sedimentary beds of shale and sandstone. The soils in these areas lack sufficient vegetative cover to adequately protect them from erosion. Barren shale and sandstone outcrops are common to the rough breaks.

There are 255,000 acres of woodland within the refuges of Montana. About 50 percent is adequately treated and 45 percent needs management type practices only. Nearly 5 percent of these lands is not feasible to treat. About 245,000 of the 255,000 acres of woodland occur in critical areas on highly erosive soils that are underlain by soft beds of shale and sandstone. Some of these lands have sparse timber and the shallow soils lack sufficient ground cover to adequately protect them from erosion. Within the past five years, fire has destroyed or damaged 8,000 acres of timber. These lands need intensive management and treatment to adequately protect them.

The Bureau has 7,000 acres of cropland, all of which is adequately treated. There are 100 acres of primitive land and 213,789 acres of water.

Most of the soil erosion contributing to stream pollution is limited to the rough breaks of the Missouri River of the Charles M. Russell Refuge. Serious erosion, much of it geologic, continues to occur along the entire length of this refuge. For the most part, streambank erosion on refuge lands is rather minor except for localized areas which include a total distance of about ten miles. A portion of this is along the banks of the Missouri River, which is considered unfeasible to control. There is substantial lakeshore erosion along the entire Fort Peck Reservoir. Adequate protection of shoreline where there is fluctuating water levels within reservoir areas is difficult and, in many places, not feasible to treat. All of the ten miles of streambanks with a serious erosion problem need structural measures for control. Improved management practices along with structural measures is needed on 10 percent of the area.

Within the wildlife refuges of Montana, roads and disturbed areas do not contribute seriously to stream pollution. Some disturbed areas, such as mining activity, near the Red Rock Lakes Refuge has contributed and does contribute to stream pollution and sediment damage.

Bureau of Reclamation Report

The Bureau of Reclamation in the United States Department of Interior administers 162,000 acres of Federally owned land and water in Montana. There are 129,000 acres of range, of which only 32 percent is adequately treated. Of the range needing treatment, 26 percent requires management type practices only, while 41 percent needs structural measures along with improved management for adequate protection. Only 1 percent of the range is not feasible to treat. This includes the badlands of shale and rock outcrop and some inaccessible areas with which they are associated. There are 7,000 acres of woodland, of which 25 percent is adequately treated, 40 percent needs management type practices only, and 25 percent needs some structural measures with improved management for adequate protection.

Other lands comprise 26,000 acres, which include water, roads and badlands. There are 4,000 acres of highly erosive lands which occur in widely scattered areas. They occupy steep slopes and often have very shallow soils lying over impervious shale and sandstone. The sparse plant cover is inadequate to protect the soil from erosion. Controlled grazing to encourage optimum vegetative cover is the best practical way to decrease erosion. Land treatment is adequate on 80 percent of the other land and 5 percent is not feasible to treat. The remaining 15 percent requires some structural measures and improved management for adequate protection.

Nearly all lands with inadequate plant cover contribute sediment to streamflow. The areas of relatively low rainfall do not support adequate plant cover. Scattered rain storms of high intensity occur intermittently and the concentration of large amounts of water causes considerable erosion and damage locally. There are very few miles of permanent streams on

Bureau lands where streambank erosion is a problem and contributing to stream pollution. Roadways and barren areas on Bureau lands are not a serious problem to stream pollution. Soon after construction the borrow areas have a more dense plant cover than adjacent lands because of the additional moisture from runoff.

National Park Service Report

The National Park Service in the United States Department of Interior administers 1,156,129 acres of Federally owned lands in Montana. This acreage represents only the park lands within Glacier and Yellowstone National Parks and does not include the smaller parks such as Big Hole, Custer, and Reno Battlefields, which are National Monuments. This report discusses Glacier and Yellowstone National Parks separately.

Glacier National Park

Glacier National Park administers 1,013,129 acres of land and water in Montana. There are 768,999 acres of woodland, of which 97 percent is adequately treated. Of the remaining 3 percent, 1 percent is land not feasible to treat and 2 percent requires management type practices only. Fire destroyed 12,381 acres of timber within the past five years. In much of this area vegetation will reestablish naturally. The range land within Glacier National Park comprises 59,040 acres, all of which is adequately treated. Fire has destroyed or damaged only 24 acres of range in the past five years. Other lands comprise 185,091 acres, which include water, glaciers, streams and roads. The treatment of these areas is adequate. The maintenance of roads and trails is an annual operation for safety in public use. The geologic formation within the Park consists of hard sedimentary rock which weathers slowly and contributes very little silt to streamflow within the Park.

Because of the National Park Service policy of perpetuation of native vegetation, erosion damage in the Park has been insignificant. The great soil groups within the Park are Cryoboralfs, Cryorthods and Cryochrepts. These soils are well to imperfectly drained. The A horizon is generally

thin, 2 to 4 inches. Topography varies from very steep in the mountainous areas (100 plus percent) to gently rolling hills and valleys. Vegetation at the lower elevations consists of lodgepole pine, larch, Douglas fir, Engelman spruce and western white pine. Spruce-fir type predominates at middle elevations, while whitebark and limber pine, associated with subalpine fir, vegetation is at the higher elevations.

Major areas, which in the past have contributed to stream pollution, have been in the southern portions of the Park, adjacent to the Middle Fork and North Fork of the Flathead River. These areas have been associated with major fires in the past. Over the years the slopes have stabilized, vegetation has been reestablished, and present erosion is negligible.

Topography in these areas is moderately steep, 40 to 75 percent, generally south or southwest slopes, with lodgepole-larch the predominant vegetation. The soils are generally Cryoboralfs. During the 1967 season 8800 acres burned in the Flathead fire, adjacent to the North Fork of the Flathead River, on the Apgar Mountains. Fortunately most of the minor drainages on the slope did not burn, which should alleviate major erosion problems. Local erosion will undoubtedly occur, but the extent will not be known until next season. Some seeding is programmed for the area this spring.

During the early summer of 1964, abnormally high precipitation coupled with rapid snowmelt resulted in extensive damage to stream courses at lower elevations throughout the Park. Approximately 100 to 150 miles of permanent streams were affected. In the past four years, stabilization has taken place, and limited structural measures have been completed.

During the past season, little pollution and sediment damage was evident except for a short period during the spring runoff. Further control would not be economically feasible.

Yellowstone National Park

Yellowstone National Park administers 143,000 acres of land and water in Montana. It has been estimated there are 128,500 acres of woodland, of which 99 percent is adequately treated and 1 percent is not feasible to treat. Range lands comprise about 10 percent, or 14,300 acres, of which about 30 percent is in good condition. Elk concentration is heavy on these lands and winter forage in some areas is depleted. Heavy spring and winter grazing pressure leaves some south and west facing slopes nearly barren. About 65 percent of the range can be controlled by improved management practices (limiting number of animals) and about 4 percent will need some structural measures with improved management. Other lands comprise about 200 acres, which include roads and water areas, mostly streams. The treatment of these lands is adequate. Some local areas where relatively young geologic formations are under constant change are not feasible to treat.

In general, soil erosion, as such, is minimal on nearly all lands located within the defined lines of the Montana portion of Yellowstone National Park. In the Mammoth area there are some sections under continual change with slippage and movement from unstable geologic formations. From time to time they slough off into the Gardner River.

Agricultural Research Service Report

The Animal Husbandry Research Division of the Agricultural Research Service in the United States Department of Agriculture administers 55,800 acres of Federally owned lands in Montana. There are 54,950 acres of range and pasture, of which 36 percent is adequately treated, 43 percent requires management type practices only, and 21 percent needs some mechanical measures with improved management and vegetative practices for adequate treatment. Only one percent of the range is not feasible to treat. This includes badlands with a high percentage of shale and rock outcrop. There are 400 acres of cropland, all of which is adequately treated. Other lands comprise 450 acres, of which 95 percent is adequately treated and 5 percent needs both structural and management type practices for protection. Highly erosive "frail lands" comprise the major portion of the area. Soils are primarily clay that has weathered from shale. They vary in depth and shale outcrop is common to the area. Much of the area has rough broken terrain and slopes range from nearly level in some of the narrow valleys to as much as 120 percent on the steep escarpments. Sparse browse cover is characteristic on the shallow soil and steep slopes at the higher elevations. The foot slopes and valleys of the drainageways where the soils are deeper have much more grass and are used more intensively by livestock. In the more erosive areas it seems doubtful that livestock or management has contributed to soil instability or that improved management alone can result in much improvement. A combination of vegetative and mechanical practices seems to offer the most promise for overcoming existing erosion and sediment damage. The major areas with soil erosion problems are located in the northwest and southwest

portion of the Station and in the rough breaks along the southern border of the Yellowstone Valley. Smaller areas with shale outcrop are found in the south central portion.

The Yellowstone River within the Station boundaries is about 8 miles long. There is appreciable streambank erosion damage on about 1.5 miles of the river. All the eroding area would require expensive structural measures for control. There is a question of economical feasibility because of the large volume of water, swift current, river depth and heavy ice movement during the winter months. The Tongue River along the east boundary of the Station is about 15 miles long. There is some streambank erosion on 1.5 miles and structural measures are required for adequate control.

Roads and trails within the Station do not receive heavy use and contribute very little to stream pollution. All abandoned roads and disturbed areas along utility lines are reseeded. Stockwater reservoirs are provided in a number of drainages, waterspreading systems are used when practical, and intensively fenced areas permit the movement of range stock for proper deferment. These are the practices being used for erosion and sediment control of the lands we administer.

Corps of Engineers Report

The Corps of Engineers in the United States Department of Defense administers 610,085 acres of Federally owned land and water in Montana. The water area (Fort Peck Reservoir) comprises 257,000 surface acres. There appears to be some duplication of reporting of water in Fort Peck by the Bureau of Sports Fisheries and Wildlife. The land area administered by the Corps of Engineers comprises 353,085 acres, most of which is under lease to the Bureau of Land Management and the Bureau of Sports Fisheries and Wildlife. Here again is a possibility of duplicate acreage being reported by Federal agencies.

There are 233,896 acres of range land administered by the Corps of Engineers which is under lease to the Bureau of Land Management. The amount of erosive lands in range use is unknown by the Corps and it has indicated 100 percent is not feasible to treat. Other lands comprise 376,189 acres, which include 257,000 acres of water. Some of the land area is under lease to the Bureau of Sports Fisheries and Wildlife. There are 8,190 acres set aside for public use and recreational sites. The acreage of the dam site and airbase are included as other lands. The amount of erosive land in this use is unknown, and the Corps reports 100 percent is not feasible to treat.

Shoreline erosion of the Fort Peck Reservoir area where there is a fluctuating water level is difficult to control, and in most cases not feasible to control. It is estimated there are 1500 miles of shoreline and beaches.

Summary

On the basis of this report, there are 7,684,855 acres, or about 42 percent, of Federally managed lands needing treatment that are feasible to treat by management and/or structural type practices. Based on the 1958 Conservation Needs Inventory, There are 64,941,894 acres of private land in the State, of which 41,063,100 acres, or 64 percent, needs treatment. This includes 14,426,223 acres of cropland, 43,142,283 acres of range and pasture and 6,796,198 acres of woodland. Based on the 1958 Conservation Needs Inventory, 7,642,600 acres, or 53 percent, of the cropland needs treatment; 30,271,000 acres, or 70 percent, of the range and pasture land needs treatment; and 2,149,500 acres, or 46 percent, of the woodland needs treatment. This does not include woodlands needing protection from fire, disease, insect or rodent damage.

Most of the perennial streamflow in Montana originates at the higher elevations on Federally managed lands. For the most part, pollution or sedimentation in Montana streams, as indicated from this survey, does not become a serious problem until streams reach the private lands adjacent to them. Based on estimates and the best knowledge we have available in the Soil Conservation Service, we estimate as much as 80 percent of the stream pollution and sediment damage from streambank erosion comes from private lands and degrading stream channels and 20 percent or less comes from Federally managed lands. Cost for adequate protection of streambank erosion is extremely high and prohibitive for most private farm and ranch operators without some outside assistance. The kinds of structural measures and protection needed are based on several factors such as stream diversion for irrigation, road construction, ice jams, etc. Streambank

protection is one of the most costly features in an adequate erosion control program in Montana. Public assistance from State or Federal sources is needed if we expect to reduce the stream load and keep sediment pollution at an acceptable level.

During the course of highway construction, thousands of acres are left bare and exposed to the erosive forces of nature. Many road locations require some channel changes in rivers and streams. This causes serious erosion problems during construction and much stream sediment pollution occurs. Policy has recently been established that stream length will not be shortened through highway construction projects. This should reduce erosion of stream channels and maintain better fish habitat.

In 1961 the Montana Legislature passed a law requiring revegetation of all areas disturbed in road construction that will support vegetative growth. Within the past 18 months, the Highway Commission has established a policy of stockpiling and replacing topsoil on all interstate projects. This will greatly facilitate establishment of adequate cover and reduce erosion. Prior to this, many construction areas remained exposed and subject to erosion. It is the policy of the Montana Highway Department to seed the disturbed areas of State and Federal highway projects, using its own maintenance crews and equipment in most divisions. Progress has been slow because of costs and lack of personnel trained in techniques of plant establishment.

County Commissioners generally have assumed responsibility for seeding disturbed areas on State secondary road projects which are funded, in part, from Federal funds. No data is available on how many of these areas have actually been seeded.

Short term erosion is difficult to prevent entirely and costs may be prohibitive in some construction projects. No estimate is available of uncontrolled erosion or of the percent that is economical to control. With improved application of the seeding program, significant reduction in sediment damage can be obtained.



